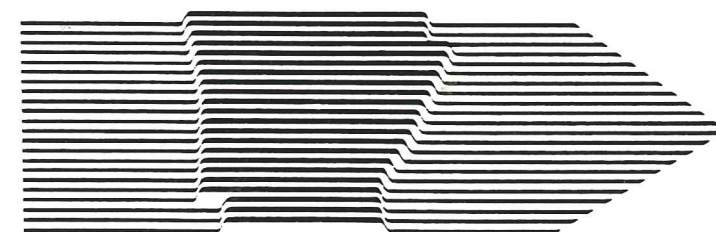


**Arkansas Science &
Technology Authority**

**Annual Report
FY 1989**

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Technology Authority**



**Annual Report
FY 1989**

The Arkansas Science & Technology Authority

Board of Directors

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Chief Executive Officer and
Chairman of the Board,
First Commercial Corporation
Little Rock, Arkansas
Term expires: 1992

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Director
Arkansas Department of Higher
Education
Little Rock, Arkansas
Permanent appointment

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Attorney
Goodwin, Hamilton & Moore
Paragould, Arkansas
Term expires: 1993
Vice Chairman

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Department of Chemistry
Ouachita Baptist University
Arkadelphia, Arkansas
Term expires: 1991
Chairman

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Dean of the Graduate School
University of Arkansas at Little
Rock
Little Rock, Arkansas
Term expires: 1993

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Term expires: 1990

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Ramsay, Cox, Bridgforth, Gilbert,
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Term expires: 1990

John Troutt
Publisher
Jonesboro Sun
Jonesboro, Arkansas
Term expires: 1992
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Term expires: 1991

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Natural Sciences Department
University of Arkansas at
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The Honorable Max Howell
Arkansas State Senate
Jacksonville, Arkansas
Term expires: 1993

The Honorable John Lipton
Arkansas House of Representatives
Warren, Arkansas
Term expires: 1993

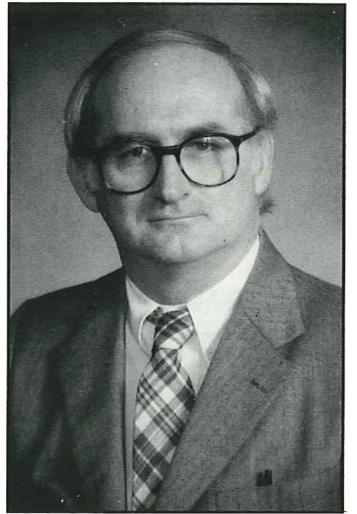
Committees:

Executive Committee
Dr. Joe Nix - Chairman
William Bowen
Harry Truman Moore
Dr. Winfred Thompson
John Troutt

Investment Committee
Harry Truman Moore - Chairman
William Bowen
Louis Ramsay, Jr.
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Planning Committee
John Troutt - Chairman
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Dr. William Willingham - Chairman
Dr. Donald Pederson
Dr. Betty Overton



Dr. Joe Nix
Chairman

June 30, 1989

Governor Bill Clinton and
Members of the 77th General Assembly
State Capitol Building
Little Rock, Arkansas 72201

Dear Governor Clinton and Legislators:

I am pleased to present the 1989 Annual Report of the Arkansas Science & Technology Authority, which charts our progress in economic development.

As ASTA closes out the decade, we look at our past accomplishments and future goals as a springboard to the 21st century, with research and technology development leading the way. The success of the programs outlined in this report is indicative of the direction the Authority will continue to pursue.

The dividends are, in part, measured by the increasing number of proposals being submitted and an overall heightened awareness of the role of science and technology throughout the state.

The Basic and Applied Research Programs this year granted a total of \$651,652.95 to scientists throughout the state, representing 25 projects, bringing the total grant expenditures since 1986 to \$1.9 million. Counting leveraged private company funds awarded through the Applied Research Program, ASTA has pumped more than \$988,338 into the state's economy this year, bringing the total actual state and private funds spent on research to more than \$2.6 million since 1986. Experts in economic development have recognized that funding research is a difficult commitment to make, since the benefits are hard to project. But due to a commitment from the state to pursue research, we have begun to see payoffs from those early efforts.

The Seed Capital Investment Program, which this year alone has conditionally invested more than \$430,000 to three companies, is thriving. The Business Incubator Program is nourishing six centers throughout the state, which provide assistance to 40 individual companies, with a total employment of 180.

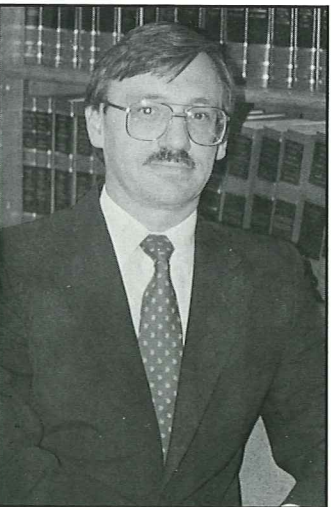
With these premium benefits to the economy, we believe the Authority is directly on course with its mission: bringing the benefits of science and technology to the people of Arkansas. These kinds of tangible results are kindled from a commitment to research - an initiative which builds a stronger economy - providing an appropriate theme for our report. We are proud of our accomplishments and contributions to the people of Arkansas and eagerly seek our future challenges.

Sincerely,

Dr. Joe Nix
Chairman of the Board
Arkansas Science & Technology Authority



Bill Clinton
Governor



Dr. John W. Ahlen
ASTA President

ASTA: A Brief History

"Arkansas can carve out a unique place for itself in the nation if, in establishing its research and development goals, particular attention is given to the future needs of the country and how Arkansas can combine its own special resources and capabilities to arrive at innovative means of meeting those needs." (Report of the Legislative Council Task Force in accordance with Interim Resolution 81-67, Jan. 1983.)

In 1983, the General Assembly created the Arkansas Science & Technology Authority through Act 859, following an insightful Legislative Council Task Force report outlining Arkansas' research strengths and the direction the state should take to capitalize on those strengths.

ASTA's mission: To bring the benefits of science and advanced technology to the people of Arkansas.

Research is the beginning and heart of all of the programs at ASTA, but it is only the first step in a well-planned series of events to stimulate Arkansas' economy.

Since 1983, the state has allocated \$7.5 million, to support ASTA's three primary programs. Despite ASTA's modest funding, this independent state agency has been recognized as a national model for research and technology-based economic development.

In the **Research Programs**, both basic and applied grant research programs have funded innovative research at Arkansas colleges and universities. From the first research grant approved in 1986, through June 1989, more than \$1.9 million in state research dollars have been granted to scientists throughout the state, representing 63 projects. Additionally, private industry matching grants to scientists have totalled \$743,322.28 since 1986.

A primary part of the Research Programs' objective is the funding of original scientific research at the state's colleges and universities, with consideration given to those with economic potential.

Technology transfer is a part of the crucial development process encouraged by ASTA. With research providing the "nuts and bolts" or "secret formulas," businesses and industries then need to be prepared to use the technology.

This program networks with the economic development staffs within state colleges and universities and assists in linking educational resources with federal

labs and private industries.

A constructive tool used in technology transfer was created in 1985, when the General Assembly authorized the Research and Development Tax Credit. The credits are available to industry sponsors of ASTA's approved applied research projects. Those eligible for tax credits can claim 33 percent of the value of their contribution, up to a maximum of 50 percent of their net tax liability. The credits are intended to stimulate private-sector support to universities and college research programs, thus motivating technology transfer and university/industry cooperation.

In another vein, ASTA promotes the federal Small Business Innovation Research Program, which competitively awards federal research and development (R&D) funds to small businesses conducting research important to major federal agencies. From business plans and feasibility studies to actual dollars, ASTA is supporting, monitoring and guiding science and technology developments in the state.

Six business incubator sites are located across the state, nurturing new technology-oriented companies through difficult start-up stages with a \$2.09 million legislative commitment.

New ideas and scientific discoveries are crucial for home-grown long-term economic development, and that development requires capital.

The **Seed Capital Investment Program** provides risk capital to companies with technology-based products or processes. Over the past three years, ASTA has been directly involved in pumping \$3.6 million into the economy through this program. Of that amount, \$2.775 million in private dollars were invested after ASTA agreed to invest \$855,000 in six companies.

The best way to map the future is to study the past. ASTA strives to do both through its **Information Program**. This program is a vehicle for providing information about ASTA's programs and digesting economic changes in the science and technology development forecast. Since 1985, this program has focused on mechanisms to bring more federal R&D dollars into Arkansas colleges and universities.

The Authority is governed by a 11-member board of directors appointed by the Governor to staggered four-year terms. Its 12-member staff is headed by the president.

FY 1989 Highlights

July 28-29 (1988): Consultants addressed Little Rock and Pine Bluff community leaders on the potential for a National Biotechnology Cooperative in central Arkansas.

September 8-9: ASTA and representatives of the National Center for Toxicological Research participated in a strategic planning session for the National Biotechnology Cooperative with consultants in Columbus, Ohio.

September 28: A successful conference on the federal Small Business Innovation Research program was hosted by ASTA and UALR. Featured speaker was Ann Eskesen, president of Innovation Development Institute, the leading private sector authority on SBIR programs.

September 28: The Energy Committee of the Arkansas General Assembly awards \$300,000 from the petroleum violation escrow fund to ASTA for energy-related research projects.

October 12: ASTA showcased the results of our programs in an exhibit for the Governor Bill Clinton's announcement of his 1989 legislative program.

Jan. 4 (1989): ASTA entered into a partnership with the Jefferson Foundation, Inc. for a preliminary assessment for planning a National Biotechnology Cooperative.

Feb. 17: A new steering committee for Arkansas' participation in the federal Experimental Program to Stimulate Competitive Research (EPSCoR) held its first meeting. As one of the original five EPSCoR

states funded by the National Science Foundation, Arkansas has the opportunity to receive another \$1.2 million over two years.

April 19: Dr. John W. Ahlen testified before a U.S. Senate Appropriations Subcommittee to urge support for FY1990 funding of the National Biotechnology Cooperative. Also, the "FDA Revitalization Act" is introduced in the U.S. Senate identifying the National Center for Toxicological Research (NCTR) as the suggested site for a national biotechnology demonstration project.

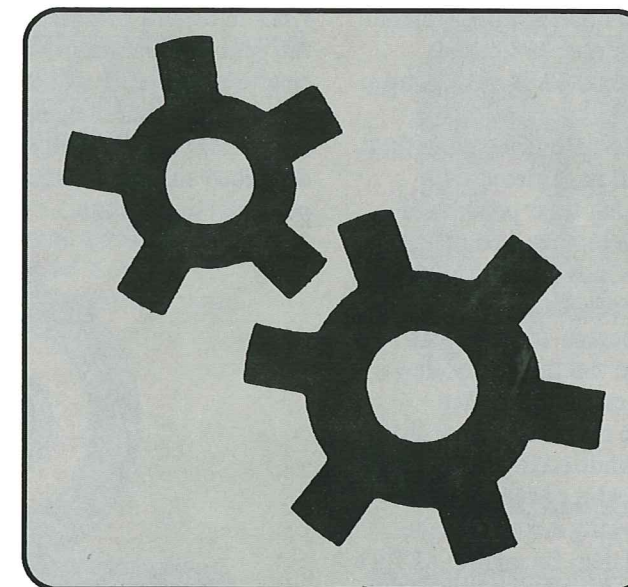
May 7: Dr. John W. Ahlen, selected to represent Arkansas, departs on an 11-day tour of three European countries to foster a technology exchange program with the United States.

May 10-13: ASTA participated in a national Astrophysics workshop held in Little Rock, which centered on discussions involving neutrinos and

the possibility of locating a Gamma Ray and Neutrino Detector (GRANDE) in Arkansas. Governor Bill Clinton later pledged support of the project and \$500,000, pending the U.S. Department of Energy's decision to build GRANDE in Arkansas.

May 19: The ASTA Board of Directors awards \$250,000 under the Business Incubator Program to the University of Arkansas at Monticello, to fund their start-up proposal for an "Industrial Renaissance Center."

June 27: U.S. Sen. Dale Bumpers' office notified ASTA that the Food and Drug Administration had released \$500,000 to begin a feasibility study and master plan for the National Biotechnology Cooperative.



Seed Capital Investment Program:

The Seed Capital Investment Program had an active year, with ASTA's Board of Directors conditionally approving three investments in Arkansas home-grown companies. Combined, these investments total \$430,000, while leveraging a total of \$1.88 million in capital from private sources. All three companies project that 55 new jobs will be created over the next two years.

This increased pace for the Seed Capital Investment Program reflects on the track record established since the 1985 Arkansas General Assembly authorized and funded this innovative program. ASTA's investment in technology-based companies since 1986 totals \$855,000, stimulating an additional \$3.88 million from private investment sources.

Firms interested in tapping ASTA's investment fund must first submit a pre-application for review. Applicants must demonstrate that their product or service is sufficiently innovative to have a competitive advantage in the marketplace. Once eligibility is determined, business plans are requested from the firm and the due diligence process begins. During this process the staff determines the viability of the new technology and potential markets are identified.

All potential investments are reviewed by ASTA's Investment Committee and submitted to the Board of Directors for final action. Investment vehicles for approved applicants include royalty arrangements, patent-participation rights and debt financing. ASTA's enabling legislation concerning the Seed Capital Investment Program allows initial financing for companies unable to secure adequate financing from traditional sources, such as banks. By statute, ASTA has the ability to invest up to \$500,000 in each project at any one time.

Once approved, ASTA's staff helps the new technology-oriented firms evaluate their business plans and assists in identifying additional sources of financing and information.

Although there are many facets to the Seed Capital Investment program, the creation and retention of technology-based jobs in Arkansas is one of the most important.

So far, 48 skilled jobs have been added to Arkansas' workforce through this program. Of these, 40 have been created by Arkansas Technologies, Inc. (ARTECH), an automation and robotics firm located

in Clarksville that makes products to streamline assembly-type production.

ARTECH reflects the type of technology-based, Arkansas-grown business ASTA proudly supports - ARTECH was initially funded by ASTA in 1986 as a start-up company with only three employees. Nthography Inc. (8 employees) and the Micoil Corporation were among the first investments made from the program. Although Micoil is no longer in operation, it represents the high-level of risk associated with financing start-up companies. These types of heavily-researched decisions reflect a part of the genuine commitment Arkansas is willing to make to give new science and technology companies a chance to grow in Arkansas.

The 1989 conditionally-approved companies that are described below also offer growth and expansion potential in the state.



Emerging Technologies, Inc.

Emerging Technologies, Inc. is a Little Rock company that has developed the world's smallest laser sighting device and is launching into the visual laser market.

The company employs advanced laser technology in sporting goods equipment, marketed as Laser Aim products. The Graduate Institute of Technology, located at the University of Arkansas at Little Rock, assisted in developing and designing the miniature power supply.

ASTA commitment: \$200,000
Other sources: \$1.05 million
Potential Jobs: 20-30 during start-up

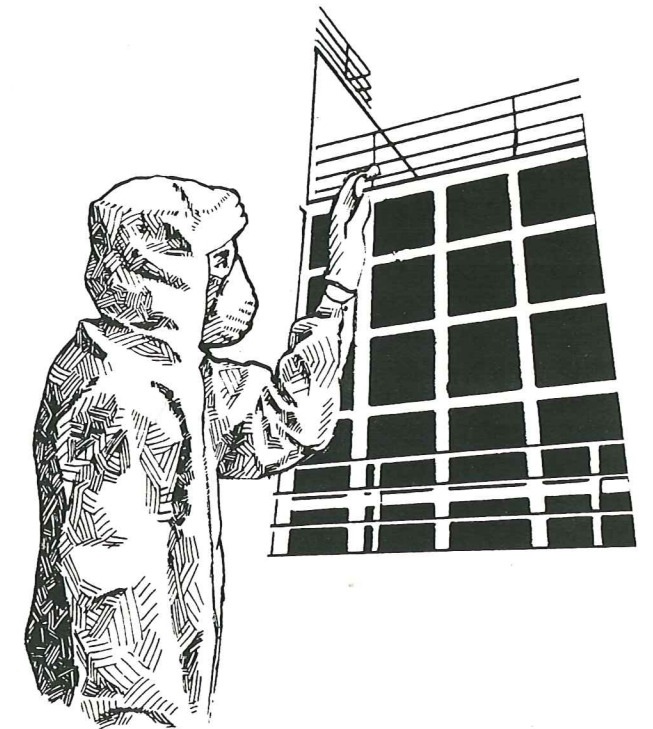
A Real Commitment to PROGRE\$\$

N-Cor Technologies, Inc.

N-Cor Technologies, Inc., of El Dorado, has developed a process to facilitate safer removal of asbestos. In contrast to the current technology for asbestos abatement, which requires some manual handling and storage of the cancer-causing agent, N-Cor's process allows a more efficient, safer containment of asbestos material.

N-Cor's technology incorporates automated vacuum techniques to remove the asbestos. The material is transformed into a slurry mix for subsequent burial in concrete form in a landfill or other storage-containment area.

ASTA commitment: \$200,000
Other sources: \$375,000
Potential Jobs: 20 new jobs over 5 years



Electromap, Inc.

Electromap, Inc., of Fayetteville, has developed and is now marketing a user-friendly, menu-driven computerized electronic atlas of the world. Their conditionally approved ASTA investment is \$30,000. The company hopes to bring the classroom into the computer age by providing information such as population, geographical and government data by simply pushing a button.

It is a reference tool designed for use by students, schools, libraries, businesses and community and economic development organizations.

With 238 full-color county, regional, world, topographic and statistical maps, it has been described as the "highest quality electronic atlas on the market today." The product was developed in cooperation with the University of Arkansas at Fayetteville.

ASTA commitment: \$30,000
Other sources: \$25,200
Potential Jobs: 3-5 during start-up



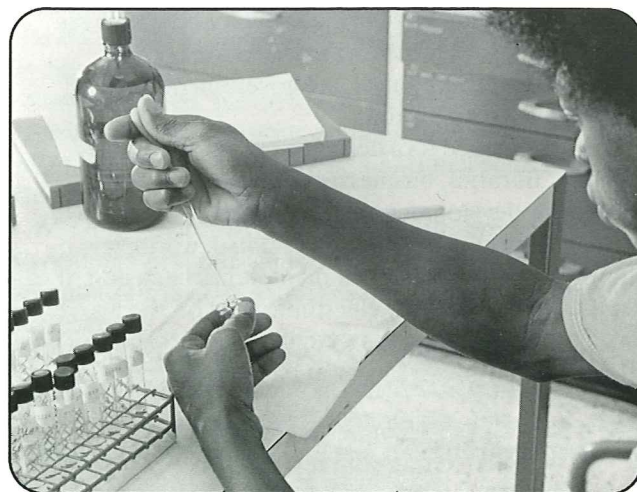
A National Biotechnology Cooperative:

"Due to the enormous resources being dedicated [to biotechnology] by foreign countries ... [there] is a need for a facility to be developed in the United States where ... organizations ... can come together to share that space and the sophisticated scientific equipment required of this work..."

The [U.S. Senate Labor and Human Resources] Committee has been informed that such a facility already exists. The government owns approximately 400,000 square feet of this high-level containment. The Committee understands that it is part of a very active and highly respected biological research facility in central Arkansas, the National Center for Toxicological Research, NCTR. ..." (Senate Report 100-600 issued by the Labor and Human Resources Committee of the U.S. Senate on October 21, 1988)

In the March 1989 issue of *BioPharm*, Steve Burrill of Ernst & Young states: "The federal government has become concerned that it is perceived as a barrier to biotechnological progress; to change this perception, it has taken several steps to support the domestic

The National Center for Toxicological Research (background) is uniquely equipped to house a national biotechnology demonstration project. The facility has over 400,000 sq. ft. of high-level containment space.

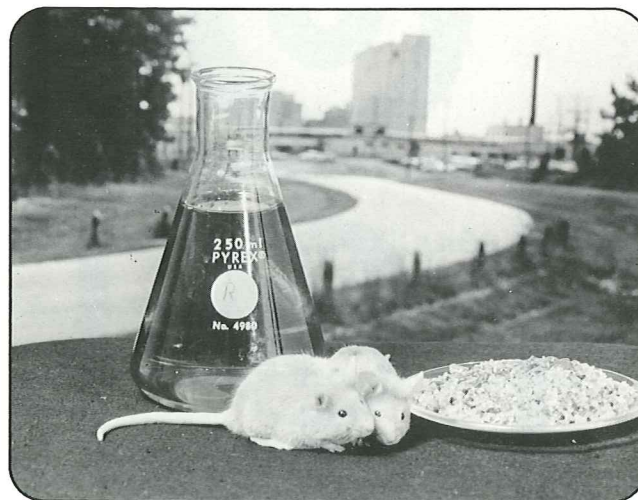


biotechnology industry. In particular, FDA has publicized its intentions to focus on assisting biotechnology companies. . ."

FDA's approach involves the use of its National Center for Toxicological Research, an internationally recognized laboratory whose sole mission is research--with no regulatory responsibilities. In complying with the requirements of the Federal Technology Transfer Act of 1986, FDA has authorized NCTR to enter into cooperative research and development agreements with industry, with the intent of moving valuable, federally-funded research into the marketplace.

NCTR's multi-disciplinary research programs focused on risk assessment, its well-equipped laboratories, 400,000 sq. ft. of high-containment space, and the support of the University of Arkansas and the NCTR Associated Universities, combine to offer a unique opportunity to nurture commercial biotechnology research and development in central Arkansas.

In the fall of 1989, the Arkansas Science & Technology Authority prepared to conduct a feasibility study and master plan for a National Biotechnology Cooperative (NBC) to be located at NCTR. The



NCTR's multi-disciplinary research programs focused on risk assessment can serve as a foundation to the growth of the biotechnology industry.

Planning for the Future

feasibility study will assess the need for such a national biotechnology demonstration project and result in a well-developed concept for the NBC. The master plan will detail facilities and equipment requirements.

U.S. Senator Dale Bumpers, a long-time advocate of the project, has pushed for funding through FDA appropriations since March 1988.

Together with U.S. Food and Drug Administration Commissioner Frank Young (who included this project in the FDA's Plan of Action III), U.S. Sen. Orrin Hatch (R-Utah) and others, Senator Bumpers has work to increase the international competitiveness of the U.S. biotechnology industry.

The National Biotechnology Cooperative would be the first demonstration project of its kind with a national agenda and scope.

By taking advantage of the available high-

containment laboratory space along with research support services and equipment, new biotech firms could substantially reduce their early-stage operating costs.

Established firms could leverage their research dollars through on-site cooperative R&D agreements. Adding to this foundation the cooperation and coordination of the federal regulatory agencies could result in more efficient commercialization of new products with benefits to consumers around the world.

The objective of this demonstration project is to overcome identified barriers to the commercialization of biotechnology products.

In effect, the larger project may be seen as a composite of smaller efforts, each directed toward barriers identified by the U.S. Congress Office of Technology Assessment.

Defined barriers to commercialization of biotechnology products

● Regulatory Uncertainty

● Patent Protection

● Lack of Capital

● Lack of Information

● Education and Training

● Adversarial Culture

The effort envisions the utilization of the facility and other resources to develop innovative approaches to address each of these barriers. Expertise would be drawn heavily from academia, industry, state and local governments, and several agencies of the federal government.

It is anticipated that the feasibility study and master plan for the National Biotechnology Cooperative will get underway in October 1989.

The Cotton Club

Arkansas researchers harvest answers

An increased need to profitably produce cotton has enhanced Arkansas' position in the global cotton marketplace, thanks to stepped-up research focused on cotton-production technology.

Arkansas' lead in cotton research began early in the decade and was boosted in 1987 when Arkansas farmers produced their biggest cotton crop in 10 years. The harvest captured the attention of the nation as the second-largest yields of record - 786 pounds of cotton per acre - were recorded.

According to figures released by the University of Arkansas' Agri-Economic and Rural Sociology Department, soybeans and rice are listed as the top cash crops in the state and cotton holds a respectable third place listing. More than 1.04 million cotton bales, averaging 480-pounds per bale, were produced in the state in 1988.

ASTA has funded three research grants that sweep the gamut of problems and innovative solutions concerning profitable, scientific cotton production.

Dr. Derrick Oosterhuis, a Division of Agriculture plant physiologist at the University of Arkansas, Fayetteville, concentrates his research on the nutritional needs and habitat requirements of cotton plants.

Early results from Oosterhuis' research show the carbohydrate or "food" needs of the cotton plant begin to decline before the cotton fully matures.

Oosterhuis' applied research grant, funded with a \$20,082 ASTA grant, matched by the Alzheimer Foundation, is aimed at management of "late-season cotton."

In currently accepted practices,

farmers apply a variety of chemicals - including nitrogen - and irrigate the plant during all phases of growth up until a few days before harvesting. Oosterhuis' research is aimed at pinpointing the exact requirements of the plant, which could save farmers time and money spent on fertilizing, irrigation and pesticides late in the growing cycle.

The university's agri-economic statistics show estimated economic benefits from this type of management could boost cotton returns by \$42 per acre, bringing in an additional \$27 million each year. The cotton lint brings in an estimated \$250 million annually and can claim credit for indirect economic benefits valued at more than \$1.08 billion in 1987, according to university calculations.

"If we can take away just one of those last-minute applications, you're talking about saving millions of dollars around the state," he said.

In Kelso (Desha County), Dr. Scott McConnell is thinking along the same lines.

McConnell, a researcher at the Southeast Research and Extension Center, is working on evaluating the increased production value of applying one company's product to cotton.

McConnell's research, funded by a \$10,052 ASTA grant matched by BASF Wyandotte Corp., is designed to evaluate the nutritional value of adding chemical treatments directly to the leaves (foliar feeding).

While all research is important and is vital to continued success, favorable results cannot be guaranteed.

In McConnell's case, the product he is studying, PIX, did not achieve the harvest-boosting success both BASF and McConnell had hoped.

According to McConnell's data, the majority of which was collected since 1988, PIX has not drastically increased the cotton plant's ability to "make a better plant."

"It doesn't always turn out the way you want it to," McConnell said. However, his research should prove valuable to BASF in future product marketing and product evaluation.

While McConnell and Oosterhuis struggle with making the best of available resources, another UAF scientist is working on how to make a better cotton plant.

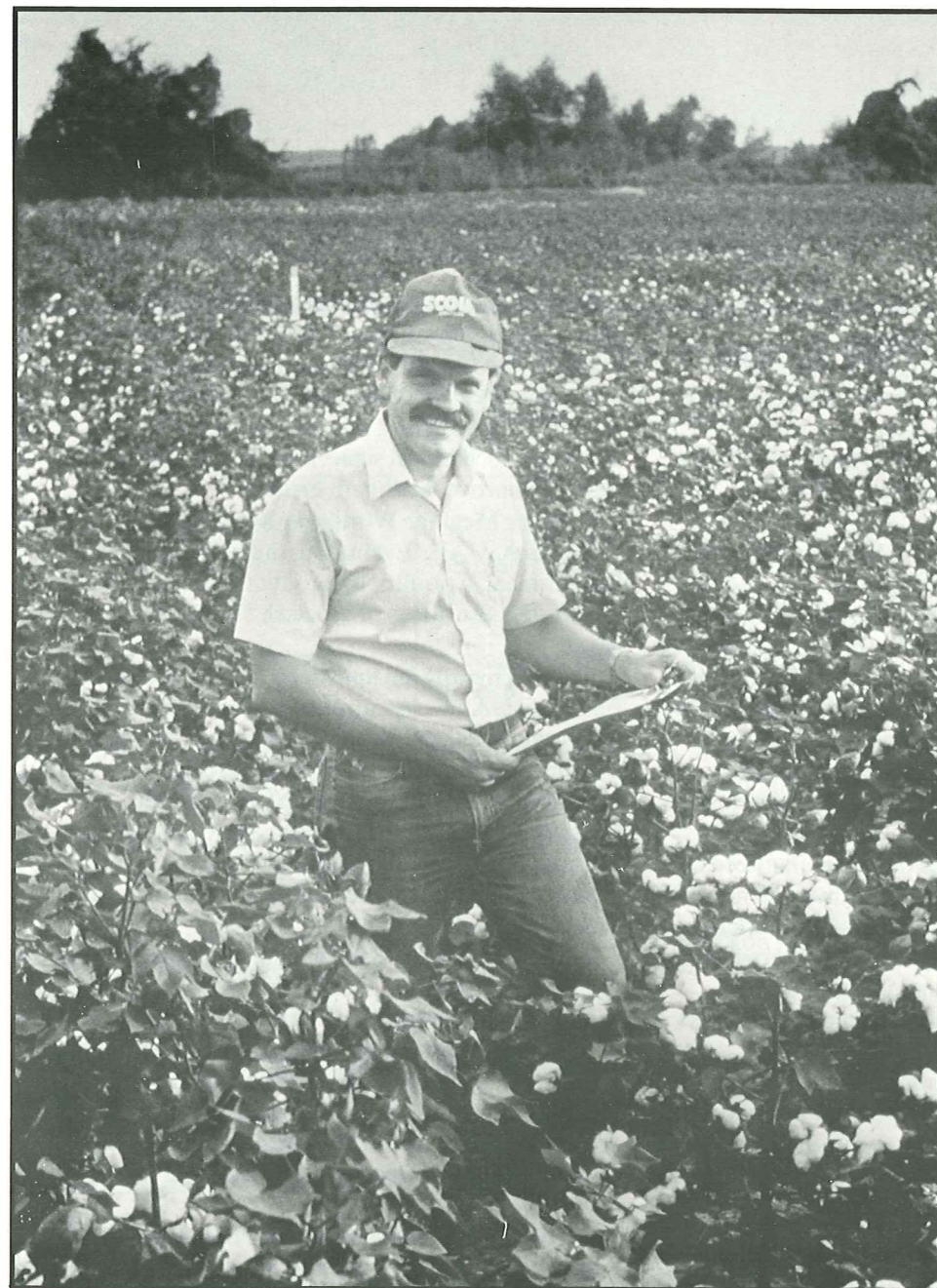
Dr. James McDonald Stewart is studying a complicated gene theory and experimenting with hybrids to create a cotton plant that will grow faster and will produce more predictable harvests.

Stewart's research, performed at UAF, is complex and involves retracing a cotton's genetic line, using painstaking cross-breeding processes that often take several growing seasons to evaluate.

Generally speaking, Stewart is trying to make the plant itself more efficient, by genetically telling the plant to take on more carbon dioxide, needed to produce nutrients, and process it quicker. While Stewart's research and subsequent applications may only slightly change the plant's ability to take on carbon dioxide, small changes could make a big difference.

Early results are slow and unpredictable.

"There is an off chance that you'll find what you're looking for the first time around, but it's unlikely," Stewart said. "You just keep trying. That's what research is all about."

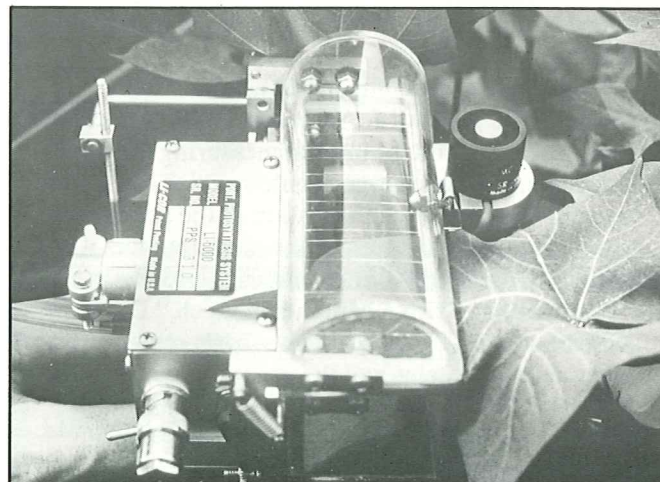


Reaping Results

Dr. Derrick Oosterhuis, (top right) rates the percentage of boll openings as part of the September 1988 end-of-season crops at the Alzheimer fields near Pine Bluff. (UAF Courtesy Photo)

A completely computerized, portable machine, which measures photosynthesis (bottom left) helps cotton researchers further study growth mechanics. (UAF Courtesy Photo)

In Kelso, at the Southeast Branch Experiment Station, Research Specialist Steve Frizzell (bottom right) applies a "top dressing" of nitrogen to cotton plants. (Staff Photo)



Exploration...

ASTA's two research programs are a fundamental driving force of the Authority's mission.

The Basic Research Grant Program is designed to support fundamental research in fields of science and engineering, while the Applied Research Grant Program links Arkansas industries to university researchers with the expertise necessary to solve industry problems.

In 1989, \$230,542.40 in grants for basic research were awarded to seven principal investigators, with another \$177,438.55 granted to researchers participating in applied research. A new category for energy-related research was added this year with a \$300,000 awarded from an petroleum violation escrow fund distributed by the Legislature's Joint Energy Committee. Including energy-related grants, the state awarded more than \$651,650 to 25 researchers at Arkansas colleges and universities.

Since applied research focuses on particular needs of a business or industry, ASTA matches investments from a sponsoring corporation on a 1:1 basis. For Arkansas firms with fewer than 50 employees, ASTA provides a 2:1 match. This year, business and industry grants totaling \$161,913.28 were awarded to nine researchers participating in this program.

Listed below are brief descriptions of each project, followed by the principal investigator and his university affiliation. A key to university abbreviations and a list of co-sponsors of applied research are on the opposite page. *(Projects featuring cotton production are included in an article on page 10.)*

"Development of a low-cost continuous area laser beam detector system by electro- and electroless-deposition processes," Drs. Robert Engelken and Hal McCloud, ASU. The team is working on an applied research grant to making a new film compound that will actually "grow" on a cylinder. The cylinder will act as a detector that will pick up laser signals.

"Expert Check and Cash Letter Management," Dr. John Talburt, UALR. Talburt is using his applied research grant to develop a computer program that will expand and enhance the traditional database applications currently used in financial media.

"Advancement of the E-SPART Analyzer," Dr. Malay Mazumder, UALR. Mazumder's applied research grant is aimed at upgrading and expanding an instrument (analyzer) used to measure electrostatic charges emitted by toners in office copiers and laser printers.

"Isolation and Use of Secretory Products of Uterovaginal Sperm Host Glands of the Hen Oviduct to Preserve the Fertility of Frozen and Non-frozen Semen of Broiler Breeder Cockerels," Dr. Grover C. Harris, Jr., UAF. This applied research grant deals with isolating biochemical secretions in order to develop ways to improve fertility in broilers.

"Feather Meal for Wintering Beef Cows," Dr. Arthur L. Goetsch, UAF. Evaluating the nutritional value of feather meal, a poultry by-product, as a winter cattle foodstuff is the focus of Goetsch's applied research grant.

"Robot Therapy for Spasticity," Dr. Stevenson Flanigan, UAMS. An applied research grant in this field is designed to test the effectiveness of mechanical therapy in stimulating paralyzed muscles.

"Development of Industrial Nitro-Organic Syntheses," Drs. Neil T. Allison and Christopher Murray, UAF. The duo's applied research project explores efficient commercial production of of nitric-acid compounds.

"NMR coils for In-Vivo Imaging and Spectroscopy," Dr. Roger M. Hawk, UALR. This basic research grant will investigate producing a variety of coils that will be used in medical diagnostic and research equipment.

"Mineralogy of the Granite Mountain Syenite," Dr. Henry L. Barwood, ATU. Barwood's basic research project identifies and studies mineral species on Granite Mountain, located in Pulaski and Saline counties.

"A Quantative Investigation of Photothermal Spectroscopies in Flowing and Stationary Media," Dr. Rajendra Gupta, UAF. This basic research grant is aimed at using lasers to investigate the way fluid flows in living organisms.

"Collisional Quenching of Metastable Atomic Oxygen," Dr. Richard J. Anderson, UAF. Anderson's basic research grant is aimed at measuring the upper-atmospheric atomic oxygen content which can lead to tracking the current configuration of the atmosphere. This is important in areas of chemical kinetics, atmospheric chemistry and combustion research.

"Evaluation of tRNA Mutants in E.coli," Dr. Scott Kirkconnell, ATU. Kirkconnell's basic research grant looks at how proteins and the genetic code are made. Results will help clarify genetic rules for making proteins and how they contribute to living cells.

(Continued on page 14)

Discovery through Research

Applied Research Grants FY 1989				
Project Description	Investigators/ University	Industry Sponsor	Sponsor's Grant	ASTA Grant
Development of a low-cost Laser Beam Detector	Robert Engelken Hal McCloud ASU	AGL Corporation	\$25,473	\$25,473
Robot Therapy for Spasticity	Stevenson Flanigan UAMS	Isokinetics, Inc.	\$40,000	\$35,417
Feather Meal Feed for Wintering Beef Cows	A.L. Goetsch UAF	Cargill, Pilgrim's Pride, River Valley By-Products	\$7,000	\$7,000
Isolation of Fertilization Bio-Chemicals for Poultry Breeding	Grover C. Harris UAF	Arkansas Poultry Federation	\$8,000	\$8,000
Development of Industrial Nitro-Organic Syntheses	Neil Allison Christopher Murray UAF	Garrison Industries	\$18,108	\$36,217
Development of a Physiological Basis for Late Season Cotton Management	Derrick Oosterhuis UAF	Alzheimer Foundation	\$20,082	\$20,082
Advancement of the E-SPART Analyzer	Malay Mazumder UALR	AGL Corporation	\$30,000	\$30,000
Expert Check and Cash Letter System	John Talburt UALR	Arkansas Systems	\$11,250	\$11,250
Total			\$159,913	\$173,439

KEY:

ASU - Arkansas State University	ATU - Arkansas Tech University
OBU - Ouachita Baptist University	UAF - University of Arkansas, Fayetteville
UALR- University of Arkansas at Little Rock	UAM - University of Arkansas at Monticello
UAMS -University of Arkansas for Medical Sciences	

The Quest for Knowledge Continues

(Continued from Page 12)

"Synthesis of Thienyl-amphetamine Derivatives," Dr. Dominic T.C. Yang, UALR. This basic research grant will explore new nuclear imaging agents, developing up to eight new imaging agents that may be valuable for clinical studies relating to strokes and epilepsy.

"Detection of Atomic Hydrogen by Magnetic Resonance in Optically-Pumped Flames," Dr. Rajendra Gupta, UAF. Gupta's basic energy-related research project investigates aspects of the combustion process, which could lead to more fuel-efficient and less-polluting engines and other combustion devices.

"Energy Conservation in Indoor Air Quality Control," Dr. Malay Mazumder, UALR. The focus of a basic energy-related research project of this type is to develop filter systems for possible use with conventional heating and air-conditioning devices.

"Design studies for GRANDE (Gamma Ray and Neutrino Detector)," Drs. Al Adams and Robert Bond, UALR. The researchers will use their energy-related basic research project to design the calibration systems and equipment for tracking neutrinos (harmless, sub-atomic particles) as they pass through the earth.

"Geologic Model of the Batson Gas Field of Johnson County

Arkansas," Dr. Roy B. VanArsdale, UAF. VanArsdale's basic energy-related research project studies the volume of gas available in shallow gas fields in the county, providing additional geological formation data.

"Investigation of Energy-Efficient Refrigerator Design," Dr. Burton Henderson, GIT. Increasing energy efficiency of commercial and institutional refrigerators through improved insulation, materials and controls is the focus of Henderson's energy-related research project.

"NMR imaging for the study of Miscible and Immiscible Core Floods," Dr. Richard A. Komoroski, UAMS. This applied energy-related research grant explores using NMR (nuclear magnetic resonance imaging) to design a model for oil recovery from existing wells.

"The Elastic Response of High-Temperature Superconductors in the Region of the Transition Temperature," Dr. Thomas J. Turner, OBU. The goal of this basic energy-related research project is to provide specific data on temperature variables for superconductors.

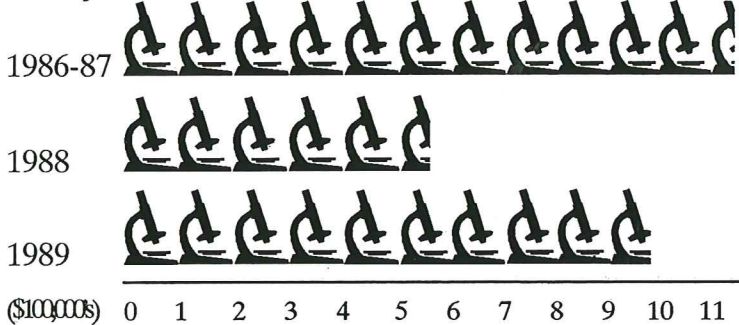
"Methane Production from Hominy Waste Digestion," Dr. Terence J. Siebenmorgan, UAF. Treating toxic wastewater - formed during the production of hominy - to produce methane gas is the aim of this basic energy-related grant.

"Heat and Moisture Transfer in Multi-Layer Walls," Dr. Rick J. Couvillion, UAF. Couvillion's basic energy-related project investigates moisture problems in structures built using energy-efficient construction materials.

Basic Research Grants FY 1989		
Project Description	Investigators/ University	ASTA's Grant
Photothermal Spectroscopies in Media	Rajendra Gupta UAF	\$77,370
Collisional Quenching of Metastable Oxygen	Richard Anderson UAF	\$43,071
Evaluation of tRNA Mutants in E.coli	Scott Kirkconnell ATU	\$22,500
Mineralogy of the Granite Mountain Syenite	Henry L. Barwood ATU	\$15,100
Synthesis of Isogenic Alloplasmic Cotton Lines	James McD. Stewart UAF	\$29,650
NMR Coils for In-Vivo Imaging and Spectroscopy	Roger M. Hawk UALR	\$11,354
Synthesis of Thienylamphetamine Derivatives	Dominic R. Yang UALR	\$31,497
Total		\$230,542

Energy-Related Grants FY 1989				
Project Description	Investigators/ University	Sponsor	Sponsor's Grant	ASTA Grant
Geologic Model of the Batson Gas Field	Roy B. VanArsdale UAF	UAF	\$39,470	\$59,200
High Temperature Superconductors	Thomas J. Turner OBU	OBU	\$24,096	\$34,917
Calibration of the Gamma Ray and Neutrino Detector (Grande)	Al Adams Robert Bond UALR	UALR	\$15,601	\$22,744
Methane from Hominy Waste	Terence J. Siebenmorgan UAF	UAF	\$5,000	\$5,000
Indoor Air-Quality Control	Malay Mazumder UALR	UALR	\$26,943	\$38,487
Heat and Moisture in Multi-Layer Walls	Rick Couvillion UAF	UAF	\$29,191	\$43,780
Atomic Hydrogen Detection by MRI	Rajendra Gupta UAF	UAF	\$15,945	\$15,392
NMR Imaging of Core Floods	Richard Komoroski UAMS	ARCO Oil & Gas	\$12,500	\$12,500
Energy-efficient Refrigerator Design	Burton Henderson UALR	American Dixie, Inc.	\$6,026	\$11,500
Total			\$174,772	\$243,520

Analysis of ASTA Research Awards*



*Includes ASTA basic, applied and energy-related grants, as well as industry-matched awards.



Business Incubators...Breeding Success

The Business Incubator Program continues to provide valuable technical and business services to the small business community statewide.

This year, the program expanded with the addition of a new incubator at the University of Arkansas at Monticello, marking six separate and distinct incubator sites across the state.

In 1985, the General Assembly approved a \$1.9 million state investment for ASTA to establish business incubators in cooperation with colleges and universities, specifically geared to meet the needs of new, technology-based companies. Basic support services, ranging from shared office services and equipment to consultations for marketing, are made available to incubator tenants.

Over 180 new Arkansas jobs have been created by 43 tenant companies served by the program since the first incubator was opened in October 1986.

In May, the Authority's Board of Directors voted to fund Monticello's "Industrial Renaissance Center" with a \$250,000 grant, following the guidelines set by the Governor's Rural Development Action Program. The creation of the incubator meets a need to cover the state geographically with incubator services, as outlined in the Governor's program. The incubator, known as an "incubator without walls," is scheduled to begin

operations in the fall of 1989. This incubator is similar to the incubator in Salem, Arkansas in the respect that a central office will be set up to assist clients, in lieu of on-site office space common in other incubator locations.

The impact of the Business Incubator Program is visible through the increasing number of companies being served by the program and the jobs that these companies support.

In 1989, participation in the incubator program grew 171 percent, from 14 new businesses in 1988 to 38 in June 1989. During this period, the number of jobs created through the incubator program has doubled from 80 in 1988 to 160 in 1989. These figures represent the current tally of employees and companies, reported from each incubator. Another five companies are official graduates of the incubator program.

Incubators provide a kaleidoscopic view of ASTA's programs. Individual companies served by the incubators have participated in the SBIR assistance program, the Seed Capital Investment Program, and the Applied Research Grant Program. The increased number of companies participating in this program are proof that incubators - as one part of a broader economic development strategy - serve to strengthen and diversify the local economy.

At a glance:

Incubators

Date established	Project name and location	University Affiliation
Aug. 1986	Genesis, Fayetteville	UAF
April 1987	The Little Rock Technology Center, Little Rock	UALR
Sept. 1987	The Business Center, Magnolia	SAU
June 1987	North Arkansas Business Incubator System, Salem	NACC
Jan. 1988	East Arkansas Business Incubator System, Jonesboro	ASU
May 1989	Industrial Renaissance Center, Monticello	UAM

SBIR - Reaching Out to Meet the Need

The Small Business Innovation Research (SBIR) program is designed to stimulate technological innovation by providing an opportunity for small firms to participate in the research and development (R&D) needs of the Federal Government.

Since 1983, small businesses have competed nationally for more than 12,000 SBIR awards totalling in excess of \$1 billion. Total Phase I and Phase II SBIR awards could average \$350 million annually for the next several years.

ASTA's SBIR assistance program was activated in 1986. Since that time, five companies have captured awards totalling \$893,451. ASTA designated a full-time staff position to promote this program in 1987.

During the September SBIR 1988 conference in Little Rock, experts noted the importance of a centralized state effort to expand participation in the program.

ASTA's SBIR program provided assistance to 60 businesses in FY 1989. The program has served 150

*1988 SBIR Award Winners

Company	Amount	Agency
Engineering Resources Fayetteville	\$50,000	Navy
Learning Express Inc. Little Rock	\$458,000	DOE
Marine Specialty, Inc. Camden	\$44,467	HHS

Key:

DOE - U.S. Department of Energy

HHS - U.S. Department of Health and Human Services

Navy - U.S. Navy

*-The federal government lists awards according to their fiscal year calendar which ends on Sept. 30.

businesses over the past three years. Services offered range from reviewing proposal submissions to coordinating university and other

resources to aid small business in the development of nationally competitive purposes.

New Programs

In March 1989, the General Assembly passed new legislation to expand ASTA's programs.

Act 803 authorizes ASTA to designate "Centers for Applied Technology."

The "centers of excellence" concept was recommended in reports released by the Governor's Commission on Arkansas' Future and the Arkansas Business Council, and compliments the reauthorized Experimental Program to Stimulate Competitive Research (EPSCoR) within the National

Science Foundation. ASTA has committed to match NSF funding up to \$600,000 annually for a two-year period to develop these centers.

The centers are aimed at providing a collaborative environment for scientists to work on research areas of economic significance to the state.

Act 271 empowers ASTA with a new economic development tool. This "Technology Development" legislation gives ASTA's Board the power to support early stage technology-development efforts,

which will enhance ASTA's existing programs that support new business growth. The legislation authorizes ASTA to serve an unmet need, allowing investments up to \$50,000 per venture to scientists developing a product evolving from basic research for further industrial application.

The investment requires a royalty provision on net sales revenues for up to 10 years. Program rules are not finalized.

1989 Mindset: Initiative

OPERATIONS	FY1985	FY1986	FY1987	FY1988	FY1989
APPROPRIATION	\$250,000	\$533,451	\$559,558	\$791,904	\$898,904
DEFERMENTS	6,187	14,013	74,587	202,361	221,389
FUNDS	\$243,813	\$519,438	\$484,971	\$589,543	\$677,515

ASTA Financial Statement

Year ending June 30, 1989

	FY 1988	FY 1989
REVENUE:		
APPROPRIATION	\$791,904	\$898,904
DEFERMENTS	202,361	221,389
TOTAL	\$589,543	\$677,515
EXPENDITURES:		
PAYROLL	\$253,616	\$280,643
EMPLOYEE BENEFITS	34,168	38,269
POSTAGE, TELEPHONE, TELEX	5,587	8,214
PRINTING, ADVERTISING	4,914	7,526
REPAIRS, MAINTENANCE	526	1,113
UTILITIES, RENT	36,841	39,452
TRAVEL, SUBSISTENCE	15,790	15,236
ASSOCIATION DUES, MEMBERSHIPS	5,724	6,001
PROFESSIONAL FEES	7,569	13,393
CENTREX TELEPHONE SERVICES	7,296	7,499
CONFERENCE, TRAINING	6,746	8,425
INSURANCE, TAXES	326	315
PUBLICATIONS, OFFICE SUPPLIES	5,483	6,720
SOFTWARE, SUPPLIES	1,894	1,187
EQUIPMENT	961	7,387
TOTAL OPERATING EXPENDITURES:	387,441	\$441,380
RESEARCH GRANTS	162,813	221,256
TOTAL EXPENDITURES:	\$550,254	\$662,636
UNSPENT ALLOCATION:	\$ 39,289	\$ 14,879

1989 Mindset: Initiative

Science Advisory Committee

Dr. Karl David Straub, chairman
Veterans Administration Hospital
Little Rock

Dr. John W. Ahlen
Arkansas Science & Technology Authority
Little Rock

Dr. Carl Cerniglia
National Center for Toxicological Research
Jefferson

Dr. Robert D. Engelken
Department of Engineering
Arkansas State University
Jonesboro

Dr. Tom Goodwin
Department of Chemistry
Hendrix College
Conway

Dr. Beverly Dawkins Lyn-Cook
Div. of Comparative Toxicology
National Center for Toxicological Research
Jefferson

Dr. Malay K. Mazumder
Graduate Institute of Technology
University of Arkansas at Little Rock
Little Rock

Dr. Frank T. Orthoefer
Vice President Research and Development
Riceland Foods, Inc.
Stuttgart

Dr. Phillip L. Rayford
Department of Physiology and Biophysics
University of Arkansas for Medical Sciences
Little Rock

Dr. Richard Speairs
Ouachita Mountain Biological Station
Mena

Dr. C. Dayton Steelman
Department of Entomology
University of Arkansas
Fayetteville

ASTA Staff

Dr. John W. Ahlen, president
James Benham, vice president finance
Dr. Joe Gentry, vice president research
Alice Rumph Smith, vice president information
Anita Millard, fiscal officer
Megan DeLamar, finance program manager
Alan Gumbel, planning manager
Andrea Harter, communications program manager
Chuck Myers, research program manager
Katherine Benefield, executive secretary
Cassandra A. Tavorn, administrative secretary
Mary L. Moon, secretary

ASTA - Building the Future with:

Abbott Laboratories
Adman, Inc.
Advanced Brake and Clutch
AEB Consultants
Aerospace Precision Parts
AGL Corporation
Alan Manufacturing
Allen Canning Co.
Allied Mushroom
Amercian Dixie, Inc.
ARCO Oil and Gas Co.
Arkansas Poultry Federation
Arkansas Systems
Arkansas Technologies, Inc.
(ARTECH)
Arrow Star
Baldwin Piano & Organ Co.
Barnwood Treasures
BASF Wyandotte Coporation
Batson Engineering
Battery Manufacturing Center
BioVantage
Blemont Publishing
Body Buoy
Bradley County Chamber of
Commerce
Cargill, Inc.
Carson Commerical Consultants
Cellcomm, Inc.
Circles and Things Limited
Computers and You
Cornerstone Companies
Cowley Ridge Aero Service
Daisy Manufacturing Company
Decision Research

Delta Fresh, Inc.
DICKY-john Corp.
Du-All, Inc.
Electromap, Inc.
Emerging Technologies, Inc.
Energy Rated Homes
Energy Techniques
Engineering Resources, Inc.
Exclusive Creations
Fabritek, Inc.
Garber's Crafted Lighting
Garner and Associated, Inc.
Garrison Inudtries
General Foods, Post Cereal Divison
Group I Cellular
Hamelly International
HHW Datacorp
Ideas Unlimited, Inc.
InertiaTECH, Inc.
Interactive Technology, Inc.
Isokinetics, Inc.
Jack R. Stone and Associates
Lester's Hobby Supply
LinGeo
Lion Shoe Industry
Magique Products, Inc.
Miah Manufacturing
Micoil Corporation
Microtronics, Inc.
Mid-South Wood Laminated, Inc.
Minteco
N-Cor Technologies
NASE (National Association of the
Self-Employed)
New Futures for Little Rock Youth

Nthography
Nutrifish
Ouachita River Chemical
Transportation, Inc.
Ozone Environmental
Technologies
Pearson Properties dba
Homes Incorporated
Pel-Freez, Inc.
Pilgrim's Pride
Pump Technologies
Riceland Foods
River Valley By-Products
Ross Laboratories
Shields Company
South Arkansas Fair &
Marketing Association
Source One, Inc.
Sulphur Pollution Control, Inc.
TCIS (Telecommunications
Information Services)
Texas Instruments, Inc.
The Alzheimer Foundation
The Citadel Research Institute
Tim Crook Associates
Timex Corporation
United Systems of Arkansas
Venture Resources, Inc.
Videofile, Inc.
Viking Industries
WAI
Water: Our Options
Waterford Design Studio
Weyerhaeuser Co.
Wilowe Institute



ARKANSAS SCIENCE & TECHNOLOGY AUTHORITY

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